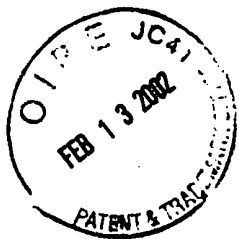


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PATENT



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Applicant:	Paul Francis DAY
Serial No.:	09/995,871
Filed:	November 29, 2001
Priority Date:	November 29, 2000
Examiner:	Not Yet Known
Group Art Unit:	1743
Title:	IMPROVED TUBES
Atty Docket:	SOMM-03-107

Cincinnati, Ohio 45202

January 18, 2001

Assistant Commissioner for Patents  
Washington, D.C. 20231

**SUBMISSION OF PRIORITY DOCUMENT**

Sir:

Attached is a certified copy of Applicant's Great Britain Utility Patent No. 0029085.8 filed 29 November, 2000, the right of priority of which has been and is claimed pursuant to the provisions of 35 U.S.C. § 119.

Applicant does not believe that any fees are due in connection with



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this response. However, if such petition is due or any fees are necessary, the Commissioner may consider this to be a request for such and charge any necessary fees to Deposit Account 23-3000.

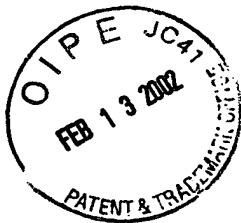
Respectfully submitted,

WOOD, HERRON & EVANS, L.L.P.

  
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partner

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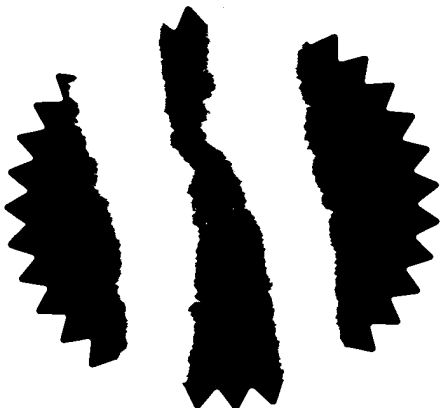
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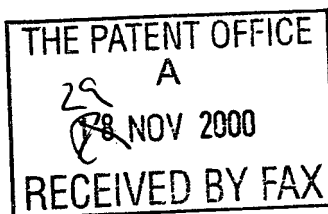
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1. Your reference

PA 3904

29 NOV 2000

2. Patent application number

(The Patent Office will fill in this part)

0029085.8

29NOV00 E587590-1 D00790  
P01/7700 0.00-0029085.8

3. Full name, address and postcode of the or of each applicant (underline all surnames)

ADVANCED BIOTECHNOLOGIES LIMITED  
Abgene House  
Blenheim Road  
Epsom  
Surrey KT19 9AP

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

7998123001  
United Kingdom

4. Title of the invention

IMPROVED TUBES

5. Name of your agent (if you have one)

SOMMERVILLE & RUSHTON

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

45 Grosvenor Road  
St Albans  
Herts AL1 3AW

Patents ADP number (if you know it)

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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
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Description 7/

Claim(s) 2

Abstract 1 8

Drawing(s) 4

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Priority documents 0

Translations of priority documents 0

Statement of inventorship and right to grant of a patent (Patents Form 7/77) 0

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77) 1

Any other documents 0  
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11. I/We request the grant of a patent on the basis of this application.

Signature

Date

Sommerville & Rushton

29 November 2000

12. Name and daytime telephone number of person to contact in the United Kingdom  
Dr Ian H Coates  
01727 854215

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DUPLICATE

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## IMPROVED TUBES

### Field of the Invention

The present invention relates to tubes bearing a unique identifying label. It is particularly applicable, but in no way limited, to labelling storage tubes such as cluster tubes.

### Background to the Invention

In science laboratories there is a growing need to operate on and store increasingly large numbers of samples. These samples need to be retrieved quickly and unambiguously as and when required. Furthermore, more and more laboratories are moving to robotic handling.

A typical example of this type of problem is when samples are kept in so-called cluster tubes stored in a cluster plate. Ideal for sample storage, a 1.2 ml micro-tube cluster plate comprises 96 individual 1.2 ml tubes held in place by a heavy duty rack in a standard microplate format. Made from clear polypropylene, each tube is fully supported at the base to withstand the pressure applied by robotic systems. Caps or mats are provided to seal each tube individually and the lid of the cluster plate has bevelled corners for a "one way" fit. Packs of loose tubes are available in order that the rack system can be re-used. The individual positions within a plate are designated in the typical 96 well format using letters A to H and numbers 1 to 12. Thus position F9 indicates a specific tube within the array. However, identification of a specific tube is more complicated when there are many tens of thousands of micro tube cluster plates held in the same storage area.

The concept of uniquely labelling each tube is known. For example, the outside of the tube on the bottom can have a two layer coating applied to it. A code

can then be etched into the top or outermost layer of the coating by a laser etching process or the like. Such tubes have been produced by matrix laser systems.

This process has a number of inherent disadvantages. Firstly, these tubes are typically used with a wide range of organic solvents including DMSO. It follows that, in the event of a spillage, the two layer coating must be completely inert to all solvents. This is not easy to achieve and inevitably increases the cost significantly.

Secondly, if the top coating becomes scratched slightly during manipulation of the tube, then this could alter or degrade the unique code by accident. This could have very serious implications for an experiment and many man hours and expensive reagents could be lost in repeat experiments. Where the original sample was unique, it could be that the experiment can never be repeated.

Thirdly, laser etching requires specialist and expensive machinery and a highly trained operator.

All of the above adds to the cost of the finished product.

In a further known example a slug of non-transparent rubber or plastics material is embedded into the base of the tube. This is then coded by laser etching directly, usually with a series of pits in the form of a binary code. Once again, if a scratch or pit finds its way onto the bottom of the tube the unique code is lost. In addition, the process for embedding or attaching a slug or layer of opaque material on the bottom of a small tube is not necessarily straightforward and adds significantly to the cost of the tube even before adding the cost of laser etching.

It is the object of the present invention to eliminate or at least mitigate some or all of the problems outlined above.

## 25 Summary of the Invention

According to the present invention there is provided a sample tube assembly incorporating a label in the base region of said tube characterised in that the label is

encapsulated within a sealed housing on the base of the tube. By encapsulating the label within a sealed housing a printed label can be used which has been printed using conventional printing technology. Laser etching is no longer required.

Preferably the tube comprises:-

- 5 (i) a tube portion, the bottom of which tube portion comprises a reduced diameter end region; and
- (ii) a bottom end cap adapted to fit over the reduced diameter end region at the bottom of the tube; and
- (iii) a label;

10 and wherein said label is accommodated in a space between the bottom or outer surface of the reduced diameter end region and the inner surface of the cap. This two-part construction means that any convenient printed label can be used and it is automatically protected from contact with solvents abrasives or the like.

15 Preferably the bottom end cap is a snap fit with the reduced diameter end region.

Preferably the bottom end cap comprises a base and an upstanding side wall substantially around the perimeter of the cap, the outermost end edge of the side wall being adapted to engage with a shoulder formed on the reduced diameter end region of the tube portion.

20 In a particularly preferred embodiment the shoulder on the tube portion incorporates a groove or depression adapted to co-operatively engage with a corresponding ridge on the end edge of the bottom end cap sidewall. This arrangement improves the quality and integrity of the seal between the bottom end cap and the tube portion.

25 Alternatively, the outermost end edge of the cap sidewall incorporates a groove or depression adapted to co-operatively engage with a corresponding ridge on the shoulder on the tube portion.

Preferably the said groove or depression comprises an endless groove or depression extending substantially around the circumference of the cap or the tub portion as appropriate.

5 Preferably the label is formed from paper. Paper, even fine quality paper or thin card is relatively inexpensive and can be printed on using conventional laser or inkjet printers. This represents a considerable cost saving.

Preferably the bottom end cap and the bottom of the tube portion are welded together to encapsulate the label within a sealed housing.

10 In a particularly preferred embodiment the welding is achieved using ultrasonic welding.

#### Brief Description of the Drawings

Embodiments of the present invention will now be more particularly described by way of example only and with reference to the accompanying drawings in which:-

15 Figure 1 illustrates a cross-sectional view of a tube according to the present invention;

Figure 2 illustrates an enlarged view of the bottom tip of the tube shown in Figure 1;

20 Figure 3 illustrates the bottom of a tube portion showing a reduced diameter end region;

Figure 4 illustrates a bottom end cap;

Figures 5 and 6 illustrate plan, cross-sectional and side elevational views respectively of the bottom end cap illustrated in Figure 4.

#### 25 Description of the Preferred Embodiments

The present embodiments represent currently the best ways known to the applicant of putting the invention into practice. But they are not the only ways in

which this could be achieved. They are illustrated, and they will now be described, by way of example only.

Figure 1 illustrates a cluster tube 10 incorporating the present invention. The detail of the bottom of this cluster tube is shown more clearly in Figure 2. Whilst the following description will show how the invention can be incorporated into a cluster tube, it will be appreciated that the invention can be applied to virtually any storage tube made of plastics material or glass.

Figure 2 illustrates the bottom end of a tube portion 11 from a storage tube assembly generally shown as 10. The bottom end of the tube portion has a reduced diameter end region 12. Adapted to fit over this end region is a bottom end cap 13. Preferably the bottom end cap 13 is a snap fit over the reduced diameter end region 12. The cap 13 consists of a base or cover 14 and an upstanding side wall 15 which extends substantially around the perimeter of the cap, with the outermost end edge of the side wall being adapted to engage with the shoulder formed on the reduced diameter end region of the tube portion. The result is a shallow cap or cup with a cross-sectional profile of a stretched U. In use when the cap is snapped into place the outermost end edge 16 of side wall 15 butts against a shoulder 17 at the interface between the bottom end of the tube portion and the reduced diameter end region 12. With the cap 13 firmly in place there is a space between the bottom or outer end surface of the reduced diameter end region 12 of the tube portion and the inside or inner surface of the cap base 14. This space is adapted to accommodate a label. The cap is then sealed onto the end of the tube portion to encapsulate the label within a sealed housing.

This sealing can be achieved in a number of ways. If the tube portion and the end cap are made of plastic, then they can be welded together, preferably using ultrasonic welding techniques. Alternatively, an adhesive can be used.

To improve the efficiency of an ultrasonic weld a "tongue and groove" effect can be created between the reduced diameter end region and the cap. For example, the shoulder region 17 can be incorporate a groove 20 which corresponds in size and shape with a ridge 21 on the end edge of the cap side wall. This latter feature is shown more clearly in Figure 4. In effect, the ridge on the cap and the groove on the tube shoulder co-operative engage with each other. However, it must be stressed that this is an optional feature and is not essential for forming a seal between the two components.

An indentation 22 on the rim of the cap around the outer circumference aids removal and placement of the cap.

It will be appreciated that this arrangement offers the great advantage that the label can be made from any suitable material. That material need not be chemically resistant to solvents such as DMSO since it is sealed within its own space. This also means that the label can be printed using conventional high definition printing techniques. No laser etching is necessary. This is particularly important because it means that a greater variety of codes and code types can be used. For example, the labels can be printed in many different colours either by using colour printing or by using different coloured substrates. Various types of bar codes or binary bit codes can be used and new types of codes can easily be adopted as they are developed.

The person skilled in the art of high definition printing will select the most appropriate substrate to use as a label. This may be a plastics material, paper or some other composite. That person skilled in the art will also select the most suitable printing process to use such as laser printing or ink jet printing.

Another advantage of this type of construction is that the action of placing the bottom end cap onto the bottom of the tube portion can be used to cut or shear the label from a sheet of labels. It will be appreciated that there is a form of

shearing action caused by the end cap side wall passing down the side of the reduced diameter end region of the tube portion. This shearing or punching action can be used to cut a label disc for a sheet. The label discs could be partially perforated before the label is punched out.

5           Assembly of the storage tube assembly then becomes a simple matter. An array of tube portions is arranged with the tubes open ends downwards, ie bottom ends up. A sheet of pre-printed labels is laid over the top of the tube array and aligned correctly with the tubes. Bottom end caps are brought over the tubes either singularly or in an array, and pressed firmly into place. Excess labelling material is  
10 removed and the end caps then sealed onto the tube portions.

          In the alternative, this assembly can be done the other way round. That is to say, cups are laid in an array, base down or open side up. A sheet of labels is laid over the top of the caps and an array of tube portions, bottom end down, are brought down and forced into the caps. To facilitate handling and arranging the  
15 caps they can be formed in an array with interconnecting links. These links are only removed once the assembly stage is complete.

          It is intended that this invention and this disclosure extends to include these various methods of assembly.

20           Whilst the tubes described thus far have been substantially circular in cross-section, it will be appreciated that any suitable cross-sectional profile of tube can be used in this invention. Thus, square or rectangular profile tubes can have bottom end caps fitted in a similar manner.

Claims:

1. A sample tube assembly incorporating a label in the base region of said tube characterised in that the label is encapsulated within a sealed housing on the base of the tube.
- 5 2. A sample tube assembly as claimed in Claim 1 wherein the tube comprises:-
  - (i) a tube portion, the bottom of which tube portion comprises a reduced diameter end region; and
  - (ii) a bottom end cap adapted to fit over the reduced diameter end region at the  
10 bottom of the tube; and
  - (iii) a label;and wherein said label is accommodated in a space between the bottom or outer surface of the reduced diameter end region and the inner surface of the cap.
- 15 3. A sample tube assembly as claimed in Claim 2 wherein the bottom end cap is a snap-fit with the reduced diameter end region.
4. A sample tube assembly as claimed in Claim 2 or Claim 3 wherein the cap comprises a base and an upstanding side wall substantially around the perimeter of  
20 the cap, the outermost end edge of the side wall being adapted to engage with a shoulder formed on the reduced diameter end region of the tube portion.
5. A sample tube assembly as claimed in Claim 4 wherein the shoulder on the tube portion incorporates a groove or depression adapted to co-operatively engage  
25 with a corresponding ridge on the end edge of the bottom end cap sidewall.



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6. A sample tube assembly as claimed in Claim 4 wherein the outermost end edge of the cap sidewall incorporates a groove or depression adapted to co-operatively engage with a corresponding ridge on the shoulder on the tube portion.

5 7. A sample tube assembly as claimed in Claim 5 or Claim 6 wherein the said groove or depression comprises an endless groove or depression extending substantially around the circumference of the cap or the tube portion as appropriate.

8. A sample tube assembly as claimed in any preceding claim wherein the label  
10 is formed from paper.

9. A sample tube assembly as claimed in any of Claims 2 to 7 inclusive wherein the bottom end cap and the bottom of the tube portion are welded together to encapsulate the label within a sealed housing.

15

10. A sample tube assembly as claimed in Claim 9 wherein the welding is achieved using ultrasound.

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11. A sample tube assembly substantially as herein described with reference to  
20 and as illustrated in any combination of the accompanying drawings.

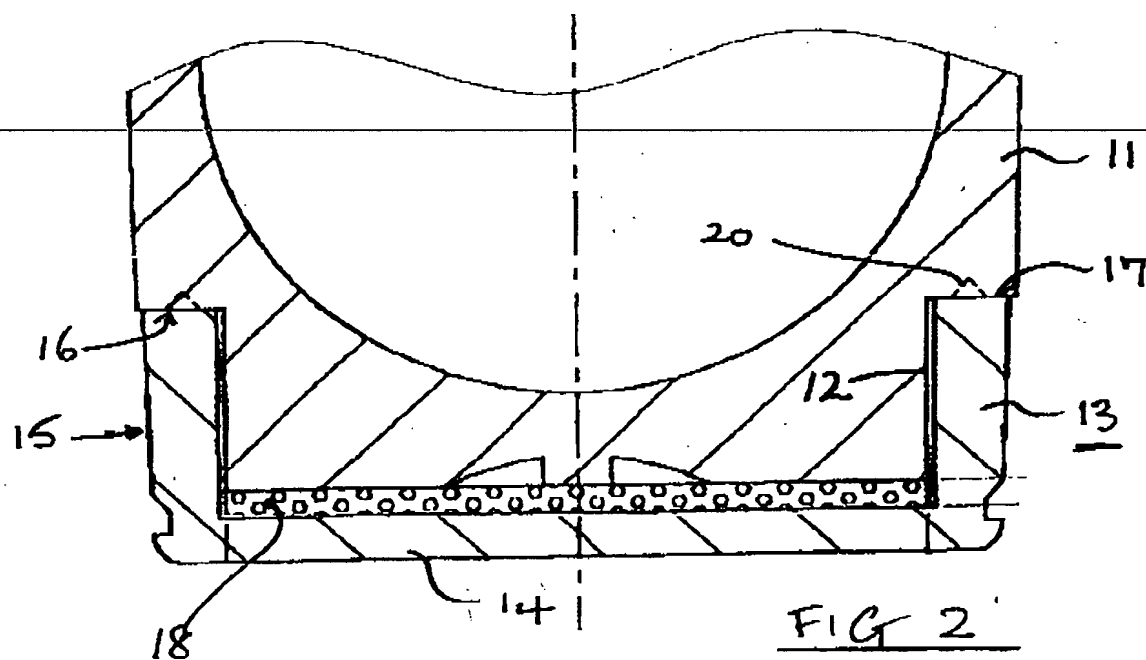
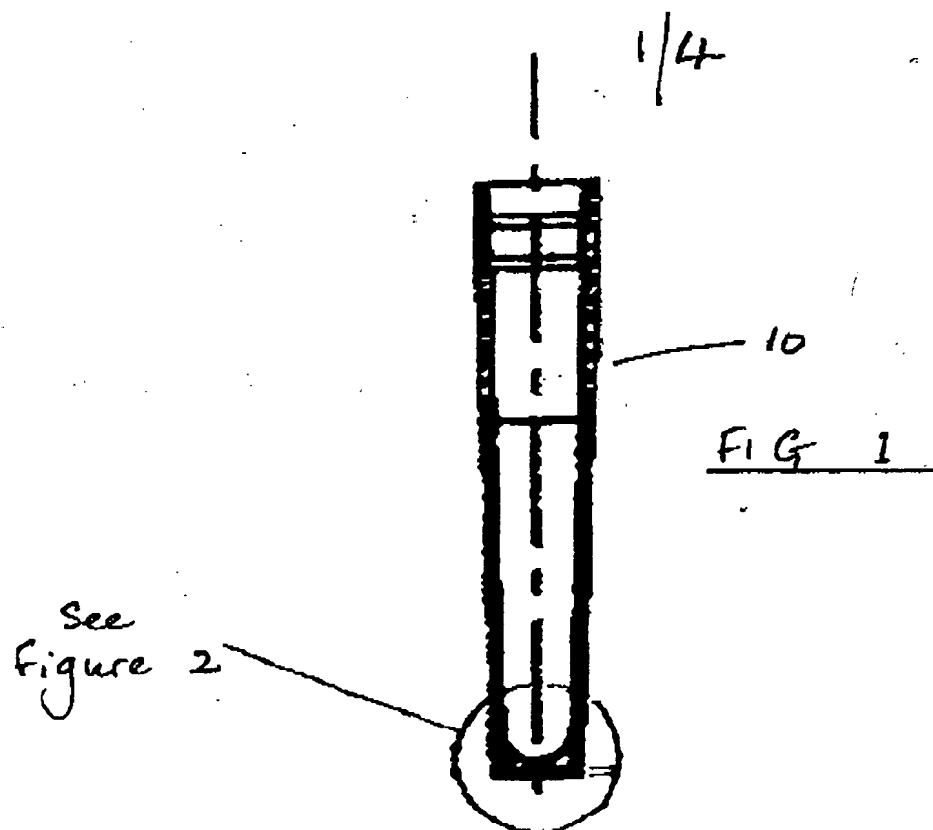
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**ABSTRACT**

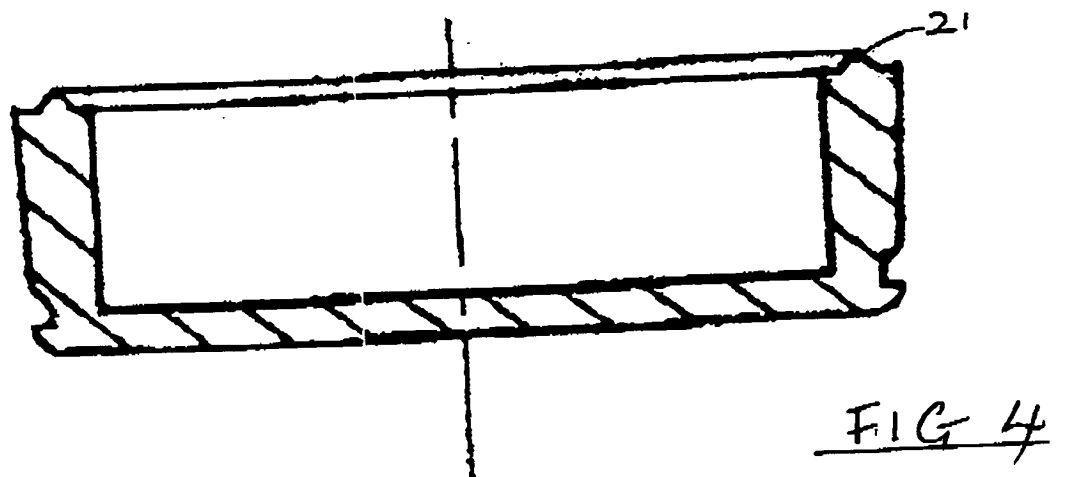
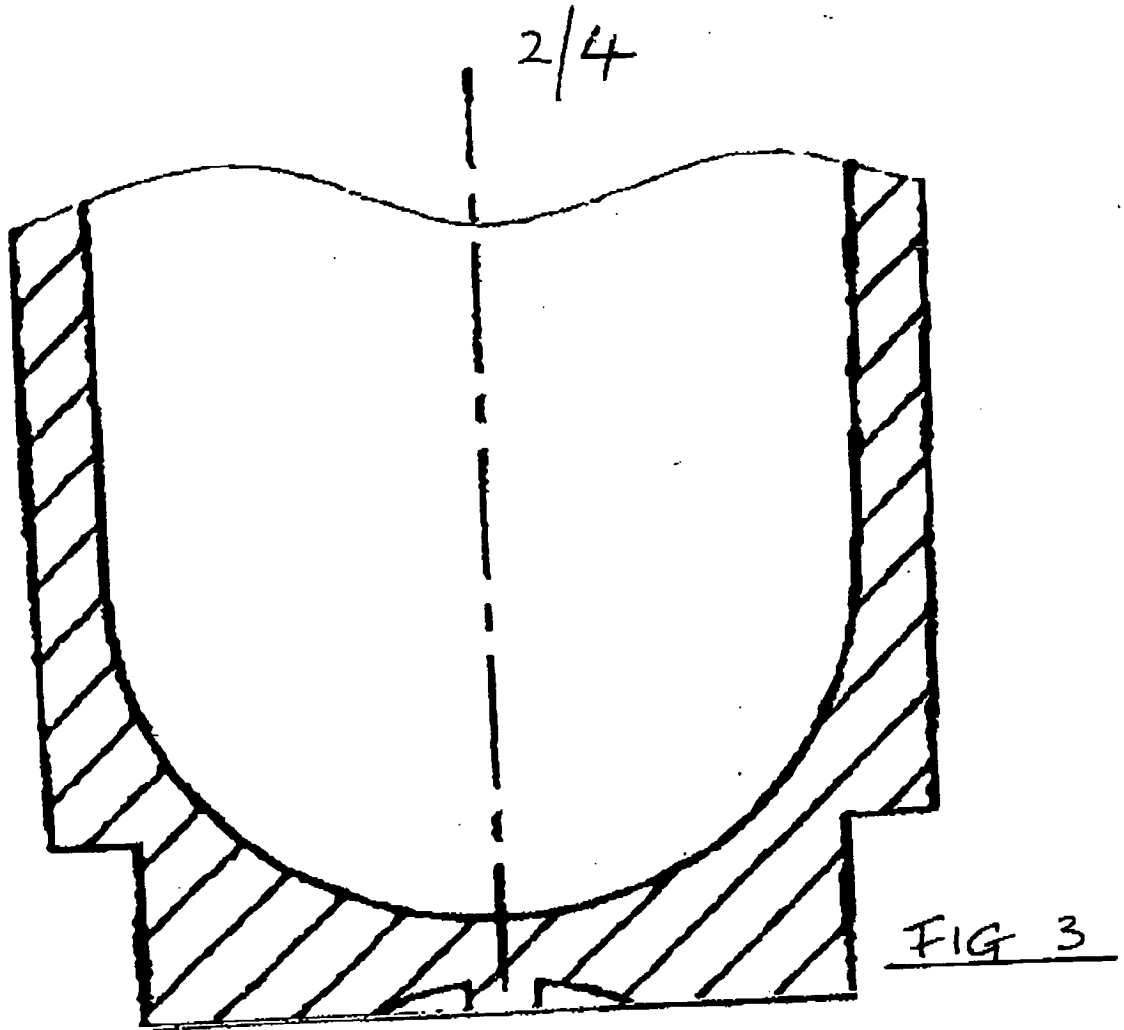
**IMPROVED TUBES**

- 5           A sample tube assembly incorporating a label in the base region of said tube characterised in that the label is encapsulated within a sealed housing on the base of the tube.

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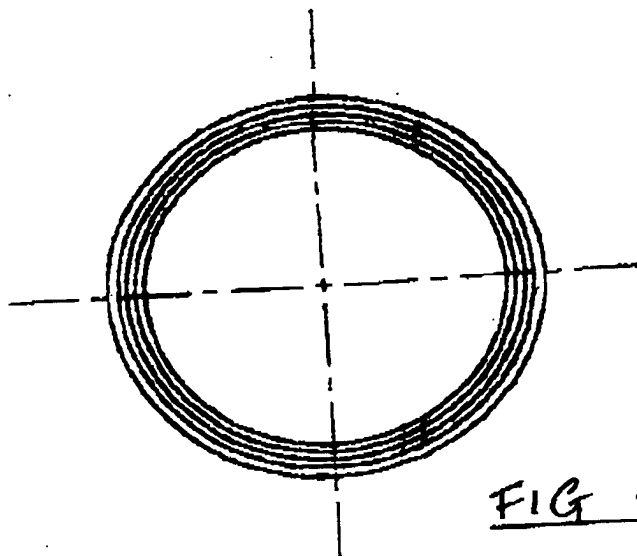


FIG 5A

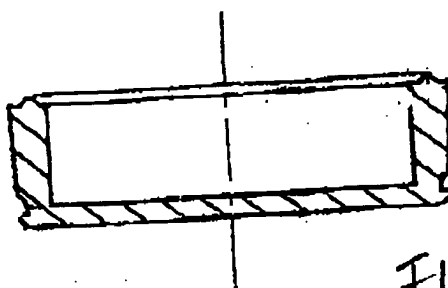


FIG 5B





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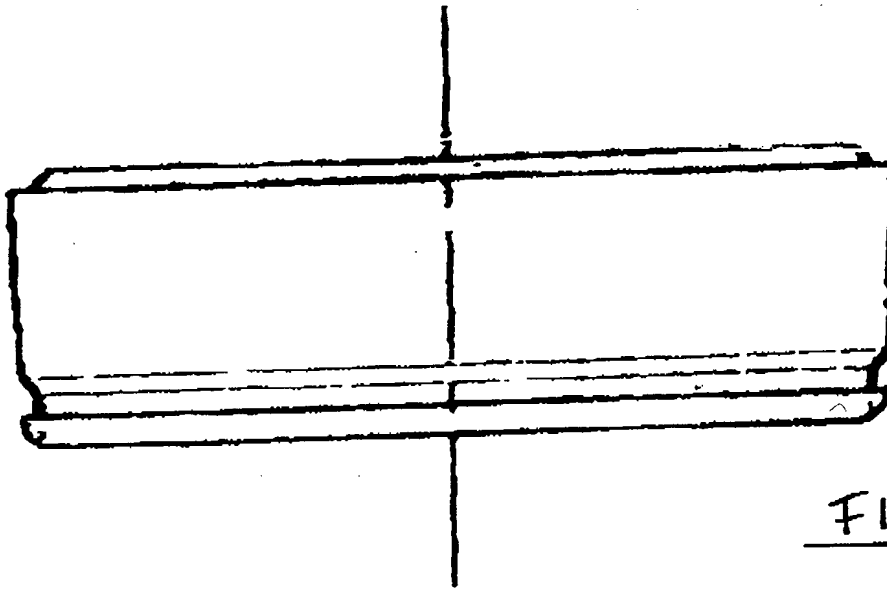


FIG 6

